

**An Investigation into the Use of Sit-to-Stand Desks on the University of British Columbia Campus**

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**University of British Columbia**

**APSC 262**

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# **An Investigation into the Use of Sit-to-Stand Desks on the University of British Columbia Campus**

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# ABSTRACT

This report has been prepared in response to an assignment for APSC 262, a course offered at the University of British Columbia. The purpose of this assignment is to investigate the feasibility of installing sit-to-stand desks on the university's campus and to recommend whether and to what extent the university should install sit-to-stand desks on its campus. The scope of this report is constrained to only the University of British Columbia staff and faculty. This report does not assess the feasibility or appropriateness of providing University of British Columbia students with sit-to-stand desks.

Overwhelming evidence shows that sit-to-stand desks improve office comfort and in some cases office productivity. Those who possess a medical need for a sit-to-stand desk typically demonstrate considerable improvement in physical health after using one for an extended period of time. Many office workers experience neck and back pain due to long uninterrupted periods of sitting. Sit-to-stand desks help users alleviate back and neck pain by allowing the user to stand for a portion of the day. There are many studies that have corroborated these statements.

The authors of this report recommend that sit-to-stand desks be provided to UBC faculty and staff who request them or have a medical need for which a sit-to-stand desk would provide medical assistance. Due to the high costs of sit-to-stand desks and the possibility that many university staff and faculty would not benefit from sit-to-stand desks, the authors believe that providing all university staff and faculty with sit-to-stand desks is exorbitant and wasteful. However, the authors believe that providing those staff and faculty who exhibit medical necessity with sit-to-stand desks will improve office comfort and productivity for these staff and faculty. In addition, the authors recommend that the university adopt this policy regarding sit-to-stand desks on a trial basis. During the trial period, the university should collect statistics about the use of its sit-to-stand desks and after the completion of the trial period, which the authors recommend to be one year long, the authors recommend that the university should reassess the integrity of the policy.

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# GLOSSARY

**Medical Necessity** - activities which may be justified as reasonable, necessary, or appropriate, based on evidence-based clinical standards of care relating to treatment of medical trauma

**Sit-to-Stand Desk** - desk designed to be used at varying heights and to be adjustable between heights while the user is at the desk

**Triple Bottom Line Approach** - a framework that advocates for the consideration of the social, environmental, and financial impacts of one’s actions

# LIST OF ABBREVIATIONS

**UBC** - University of British Columbia

## **Section 1.0 Introduction**

This report has been prepared in response to an assignment from APSC 262, a course offered at the University of British Columbia (UBC). The nature of this assignment is to determine the feasibility and necessity of installing sit-to-stand desks on the UBC campus. The authors of this report are undergraduate students in the UBC engineering program.

This report is divided into a number of sections. Beginning with the second section, Section 2.0 provides an overview of sit-to-stand desks and their use in office environments. Section 3.0 provides the nature of the authors' primary investigation into the use of sit-to-stand desks on the UBC campus. Similarly, Section 4.0 provides the nature of the authors' secondary investigation into the use of sit-to-stand desks on the UBC campus. Section 5.0 discusses the ways in which the authors measured the feasibility and necessity of sit-to-stand desks on the UBC campus. Finally, Section 6.0 provides the authors' conclusions and recommendations to UBC regarding the use of sit-to-stand desks on the university campus.

## Section 2.0 Overview of Sit-to-Stand Desks

The purpose of sit-to-stand desks is to allow users to alternate between sitting and standing while working. Sit-to-stand desks function just like ordinary desks in that they have a large, smooth surface to work on, but the key difference is that they can be adjusted to varying heights while the user is using the desk. Different kinds of sit-to-stand desks allow for different elements of the desk to be adjusted to varying heights.

There are a number of different designs of sit-to-stand desks. Some sit-to-stand desks use an electric motor to raise and lower the desk. For this kind of sit-to-stand desk, there is an electric button that powers the motor. The user simply has to press the button to raise or lower the desk to the preferred height. This kind of sit-to-stand desk is quite expensive with cost usually ranging between \$800 and \$2,500. This kind of sit-to-stand desk generally has a larger surface area to work on and can be adjusted to a greater range of heights than the other two types of sit-to-stand desks that are discussed in the succeeding paragraphs. In addition, the kind of sit-to-stand desks excels at allowing the user to adjust the height of the entire desk instead of just a portion of it. The following figure illustrates this kind of sit-to-stand desk:



Figure 1: A motor-powered sit-to-stand desk  
Source: <http://lib.store.yahoo.net/lib/thehumansolution/UpLift-445-action.jpg>

The second kind of sit-to-stand desk is one that does not have a motor and is instead limited to a system of springs and levers. The user must manually move the workspace to the preferred height. Generally, this kind of sit-to-stand desk costs less than \$500 and the amount of workspace whose height can be adjusted is reduced when compared to the previous type of sit-to-stand desk. This type of sit-to-stand desk is illustrated in the following figure:



Figure 2: A sit-to-stand desks consisting of a system of springs and levers  
Source: [http://www.chairlines.com/site\\_assets/www.chairlines.com/images/dynamic/45-405-026-workfit-LX-sit-stand-system-ergotron-03.jpg](http://www.chairlines.com/site_assets/www.chairlines.com/images/dynamic/45-405-026-workfit-LX-sit-stand-system-ergotron-03.jpg)

Finally, the most elementary versions of sit-to-stand desks are simple structures that can be used to boost and lower workspace height. This kind of sit-to-stand desks usually costs less than \$100 and has only one set height that the user can raise the workspace to. The following image illustrates this kind of sit-to-stand desk:

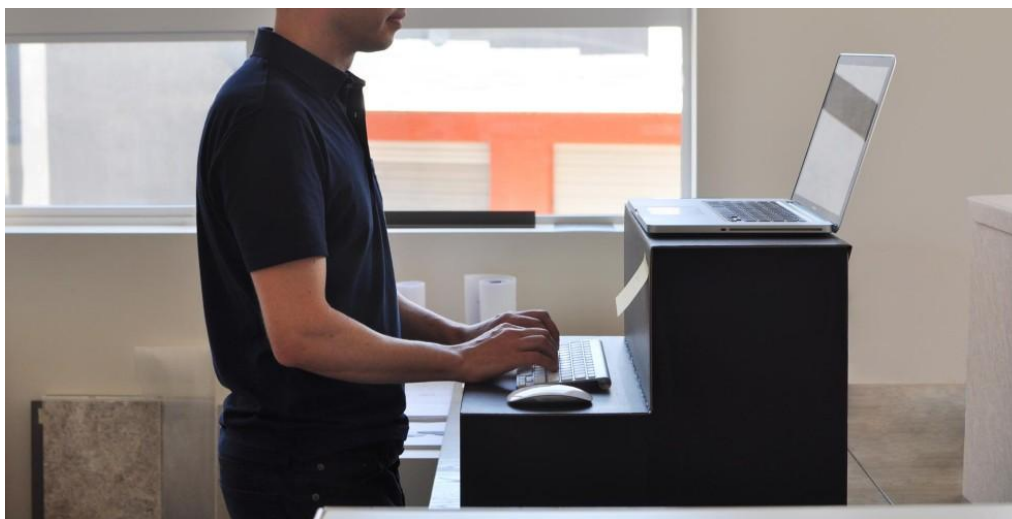


Figure 3: The most rudimentary version of a sit-to-stand desk, consisting of only a cardboard structure to boost the workspace  
Source: [http://www.vancitybuzz.com/wp-content/uploads/2016/01/ori\\_main\\_web-984x500.jpg](http://www.vancitybuzz.com/wp-content/uploads/2016/01/ori_main_web-984x500.jpg)



## Section 3.0 Primary Investigation

A major aspect of the authors' primary investigation consisted of first-hand experience with sit-to-stand desks. One of the authors, Alexander, owns a sit-to-stand desk and uses it extensively while studying. Alexander spends typically between five to six hours every day at his desk. Alexander feels that his sit-to-stand desk has substantially improved his comfort and his capacity to work at his desk. Before owning his sit-to-stand desk, Alexander experienced significant neck and back pain from spending many long hours studying at his desk. With access to a sit-to-stand desk, Alexander can now easily alternate between standing and sitting. Although he admits that it took some time to get adapted to working while standing, Alexander's back and neck pain have markedly reduced with his sit-to-stand desk. Alexander spends about 80% of his time at his desk sitting and about 20% of his time standing. On average he will sit for about 20 minutes and then stand for about 5 minutes before returning to sitting. Although he has tried setting exact timers to dictate how long to stand and sit for, Alexander has used his sit-to-stand desk long enough to know when his body needs a break as the optimal amount of time to sit and stand for is dependent on how Alexander's body feels each day. Without his sit-to-stand desk, Alexander would have a lot of difficulty studying and would have to take many breaks to stand up and walk around.

The second method in which the authors conducted their primary investigation was through their client for this project. Abigail Overduin is UBC's ergonomics advisor. At the beginning of the project, Abigail described the nature of the project to the authors and provided some information about sit-to-stand desks on the university campus. Abigail reported that in some departments at the university sit-to-stand desks are available to faculty in a communal area. No faculty members have their own sit-to-stand desks in their offices, but in certain departments faculty members may use communal sit-to-stand desks if they are available. Abigail reported that these sit-to-stand desks are quite popular among faculty.

## Section 4.0 Secondary Investigation

There are many academic articles that endorse sit-to-stand desks and advocate that taking breaks from sitting reduces one's likelihood of developing back and neck pain, improves overall health and in some cases improves productivity.

Research has consistently shown the advantages of standing over sitting. Studies have found that compressive forces on the back are approximately 40% greater when seated upright versus standing upright and that the nature of desk work promotes poor posture which can lead to back and neck pain. In addition, standing reduces one's cholesterol level by 20% when compared to sitting, facilitates blood circulation, increases metabolic rates by 25% when compared to sitting, and burns thirty to sixty more calories per hour than sitting. Also, the lowest-percentage of people who spend many hours each day at a desk without back or neck pain are those who take regular breaks from sitting. The following figure illustrates how muscular activity changes with sitting and standing:

### Sitting Induces Muscular Inactivity

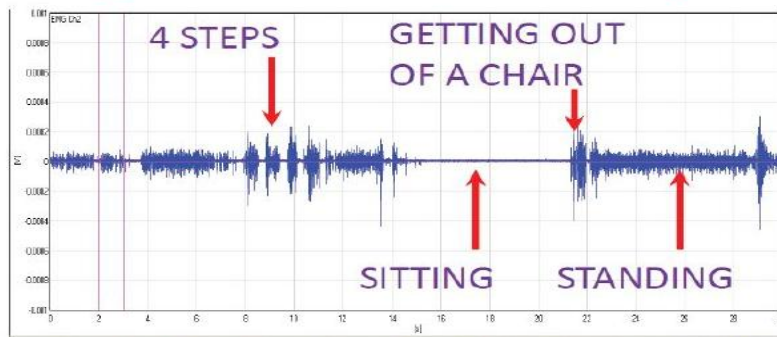


Figure 4: Muscular activity changes with sitting and standing

Source: [http://blogs.ergotron.com/wp-content/uploads/2014/08/EMG\\_DrHamilton.jpg](http://blogs.ergotron.com/wp-content/uploads/2014/08/EMG_DrHamilton.jpg)

An article in Medical News Today described a study conducted by researchers at the University of Iowa in Iowa City that analyzed sixty-nine office workers who have access to sit-to-stand desks. The study found that office workers who have access to sit-to-stand desks walk on average an additional six minutes every day and burn on average an extra eighty-seven calories every day. Since 1960, sedentary jobs have increased by 83% in the United States and 43% of jobs in the United States are now sedentary. In addition, office workers sit for more than 80% of the workday, placing them at increased risk for many sedentary-related pathologies. Such a high level of physical inactivity is thought to raise the risk of developing chronic conditions such as cardiovascular disease, high blood pressure and obesity. The study's findings support redesigning the traditionally sedentary office environment as a potentially cost-effective approach for fighting the obesity epidemic and that sit-to-stand desks offer a sustainable approach to getting sedentary workforces to spend less time sitting and more time standing. The following figure shows a graph of the reduction of activity levels in the workplace in the United States since 1960:

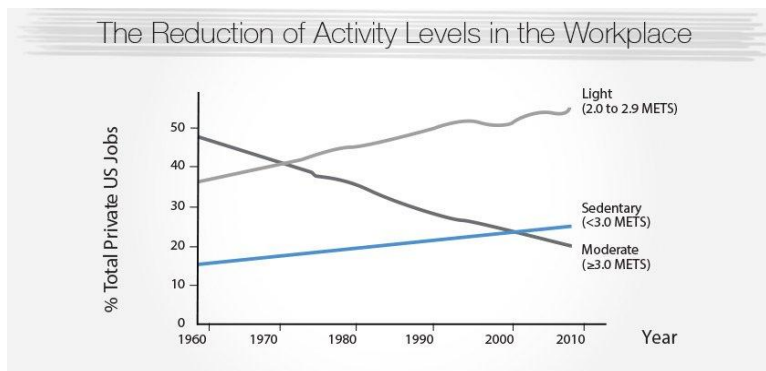


Figure 5: The reduction of activity levels in the workplace in the United States since 1960

Source: <http://media.lifespanfitness.com/media/articles/health/workplace-activity-levels-graph.jpg>

In April 2014 an article appeared in the *Official Journal of the Federation of American Societies for Experimental Biology* that discussed a case study in which thirteen office workers were provided with sit-to-stand desks. The study, conducted by James Roemmich, recorded the effects of sit-to-stand desks on the office workers. After using the sit-to-stand desks for several hours, the office workers reported decreased tiredness, increased perceptions of amount and quality of work completed, and no change in musculoskeletal discomfort or energy intake. In addition, the office workers reported that they were less productive while standing than sitting. The office workers conceded that given more experience with sit-to-stand desks, their levels of productivity while standing would likely increase.

In June 2015 an article was published in the *Journal of Public Health* in which a study was conducted on a group of elementary school students. The study evaluated the amount of time that Australian children spend sitting at school and the impacts that sit-to-stand desks have on their overall sitting time. The study involved forty-four children over a period of ten weeks and concluded that sit-to-stand desks effectively reduce classroom sitting time, but that long term efficacy trials are still needed to determine the long term impacts of health and learning on children. The study conceded that encouraging the students to use the sit-to-stand desks regularly was difficult because the children did not wish to use the desks and did not fully understand how to use them. In a controlled testing environment, the children used the sit-to-stand desks regularly, however when the sit-to-stand desks were implemented in their classrooms, their usage decreased significantly. However, in a follow up experiment there were no significant changes in classroom sitting time in a United Kingdom control group, while there continued to be a significant reduction in the Australian control group. The study concluded that the same test conducted on different people of the same age range offers varying results and therefore the usage of sit-to-stand desks varies with each individual. This and similar studies show that sit-to-stand desks are not popular among all groups of people.

An article published in the *International Journal of Behavioral Nutrition and Physical Activity* reported that researchers at the University of Sydney in Australia concluded that replacing one hour of sitting each day with walking can reduce the risk of premature death by up to 17%. The study involved over 200,000 adults who were middle-aged or older. To conduct their research, the team used statistical modeling of health data from study subjects over a four-year period. When one hour of walking or exercising each day was replaced with sitting or some other sedentary behavior, the researchers found a 13-17% increase in early death risk.

Although less research has been performed to analyze the effects of sit-to-stand desks on productivity, sit-to-stand desks have been shown not to reduce productivity levels and in some cases to increase productivity levels. An article written by University of Waterloo professors Thomas Karakolis and Jack Callaghan analyzed fourteen environments in which the effects of sit-to-stand desks on office workers were recorded. Of these fourteen environments, eight reported a productivity outcome and of these eight environments, three reported an increase in productivity with the use of sit-to-stand desks, four reported no effect on productivity and one reported mixed productivity results. The professors concluded that sit-to-stand desks do not reduce productivity.

The preceding articles are just the beginning of a long list of articles that advocate that standing has large positive impacts on health, comfort and productivity.

## Section 5.0 Indicators for Assessment

The three indicators for assessment that the authors used to motivate their conclusions and recommendations about the use of sit-to-stand desks on the UBC campus were the social, economic and environmental impacts of sit-to-stand desks. The authors derived these three factors from the Triple Bottom Line approach which advocates that one should evaluate the social, environmental and economic impacts of one's actions. More traditional approaches focus solely on monetary gains. The authors concluded that sit-to-stand desks impact each of these three categories in significant ways.

Sit-to-stand desks impose social impacts on those who use them. First, and most important, sit-to-stand desks improve comfort. As discussed in this report, studies have shown that office workers who use sit-to-stand desks experience increasing levels of comfort and general well-being. In addition, sit-to-stand desks in office settings create the idea that the employer cares about his or her employees. Even those office workers who do not experience increasing levels of comfort from sit-to-stand desks feel at least subconsciously that their employer wishes to foster a community of caring. This increases office satisfaction. In addition, sit-to-stand desks can provide a method for physically handicapped employees to complete their work. For example, a sit-to-stand desk could be lowered to the height of a wheelchair to accommodate an employee in a wheelchair.

Sit-to-stand desks impact the environment. Just like most other kinds of technology, sit-to-stand desks require material and energy to be produced. Therefore, sit-to-stand desks create a strain on the environment by requiring that wood and metal be extracted from the earth and that energy be consumed to produce the desk. In addition, any desks that are replaced by sit-to-stand desks that are not reused are added to landfills and further impact the global environment. Also, the average lifetime of sit-to-stand desks is shorter than regular desks and thus sit-to-stand desks have to be replaced more frequently than regular desks.

Not to be forgotten, sit-to-stand desks mandate economic impacts. The most notable economic impact that sit-to-stand desks impose is their initial cost. A sit-to-stand desk can easily cost over \$2,000, and therefore sit-to-stand desks' initial costs can create concern for institutions wishing to provide their workers with these kinds of desks. On the other hand, sit-to-stand desks have been shown in some cases to improve office productivity and in almost all cases to improve comfort and health. Improvements in productivity dictate lower costs of labour and improvements in comfort and health elicit fewer sick days. Fewer sick days mean lower costs for employers and reduce the likelihood that institutions lose out on employees not being able to attend work on important days.

## Section 6.0 Conclusions and Recommendations

The evaluation of sit-to-stand desks in regards to their social, economic, and environmental aspects are controversial. In the social aspect, sit-to-stand desks help users avoid back and neck pain, improve health levels, and allow morale to increase in the workplace. In the environmental aspect, sit-to-stand desks create waste and thus impose burdens on the environment. Finally, in the economic aspect, sit-to-stand desks are significantly more expensive than traditional desks, but potentially create the opportunity to save money in the future.

Based on their research, the authors recommend that sit-to-stand desks be implemented on a trial basis on the UBC campus. The authors recommend that sit-to-stand desks be provided to UBC faculty and staff who request them or have a medical need for which a sit-to-stand desk would provide medical assistance. The authors recommend that the trial period be one year long. During this trial period, the authors recommended that the university collect statistics from faculty and staff who are using sit-to-stand desks. The authors recommend that the university record how long each user perceives he or she is standing compared to sitting at his or her desk, how much each user perceives increased or decreased comfort and how much each user perceives increased or decreased productivity. Such statistics will help inform any decision that the university makes beyond the one-year-trial-period regarding the role of sit-to-stand desks on its campus. Looking forward beyond the one-year-trial-period, the authors expect that the university will elect to maintain its policy on sit-to-stand desks indefinitely. Of course, this decision is the university's and statistics need to be collected before the university can make any final decision.

The authors recommend that the university not provide sit-to-stand desks for all of its staff and faculty regardless of whether each staff or faculty member requests one. Research has shown that some people do not use the standing feature of sit-to-stand desks, and therefore to provide all UBC staff and faculty with sit-to-stand desks is wasteful.

In addition, to reduce the environmental impact of the sit-to-stand desks that UBC purchases, the authors recommend that any desks that the sit-to-stand desks replace be reused in some fashion. The authors recommend that the existing desks either be continued to be used on the university campus or be donated to charity.

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